

STRUCTURAL DESIGN - II

03. Welded Connections

Kiran S R

Lecturer

Department of Civil Engineering

Central Polytechnic College Thiruvananthapuram

March 3, 2021



Contents

1 Introduction

- Welding

2 Types of Weld

- Groove Weld
- Fillet Weld
- Slot & Plug Weld

3 Design of Welds

- Assumptions



Introduction

Welding

- Welding is a fabrication process whereby two or more metal parts are fused together by means of heat, pressure or both.
- A weld-pool of molten material is formed and the parts shall join together as it cools. A filler material may or may not be used.
- Unlike Soldering, welding melts the base material.



Types of Weld

The welds may be classified into four types as follows:

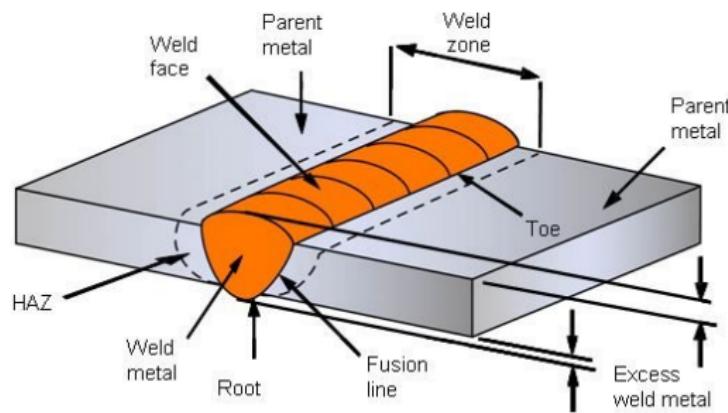
- ① Groove welds
- ② Fillet welds
- ③ Slot welds
- ④ Plug welds



Types of Weld

Groove Weld

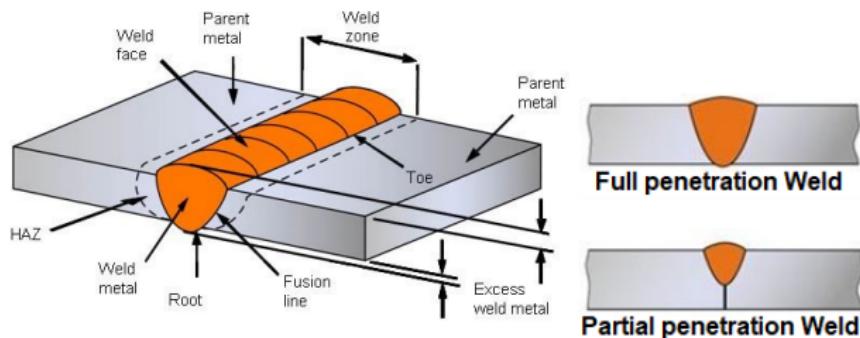
- Groove welds are used to connect structural members that are aligned in the same plane and often used in **butt joints**.
- The grooves have a slope of 30° - 60° . Edge preparation becomes necessary for plates over 10mm thick for manual arc welding, and over 16mm thick for automatic welding.



Types of Weld

Groove Weld

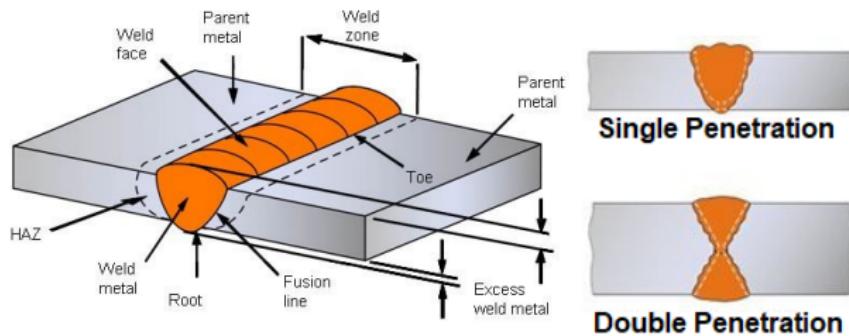
- Since groove welds will transmit the full load of the members they join, they should have the same strength as the members they join. Hence, only **full penetration groove welds** are often used. **Partial penetration groove welds** should not be used especially in fatigue situations.



Types of Weld

Groove Weld

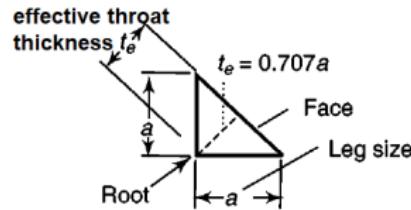
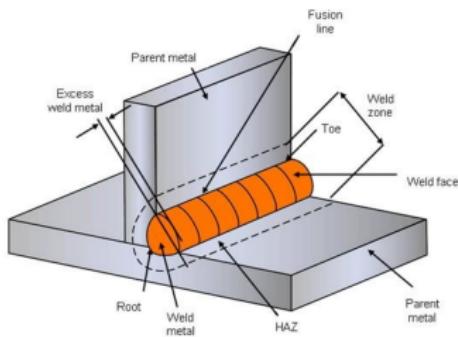
- Choice between **single** or **double** penetration depends on access on both sides, the thickness of the plate, the type of welding equipment, the position of the weld, and the means by which the distortion is controlled.



Types of Weld

Fillet Weld

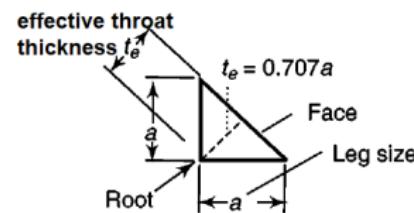
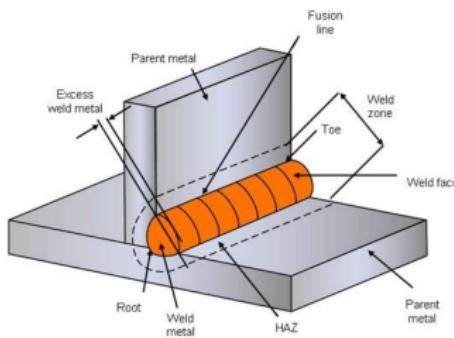
- They are approximately triangular in cross section.
- Unlike groove welds, they require less precision in 'fitting up' two sections, due to the overlapping of pieces. Hence, they are adopted in field as well as shop welding.
- Since they do not require any edge preparation (edge conditions resulting from flame cutting or shear cutting procedures are generally adequate), they are cheaper than groove welds.



Types of Weld

Fillet Weld

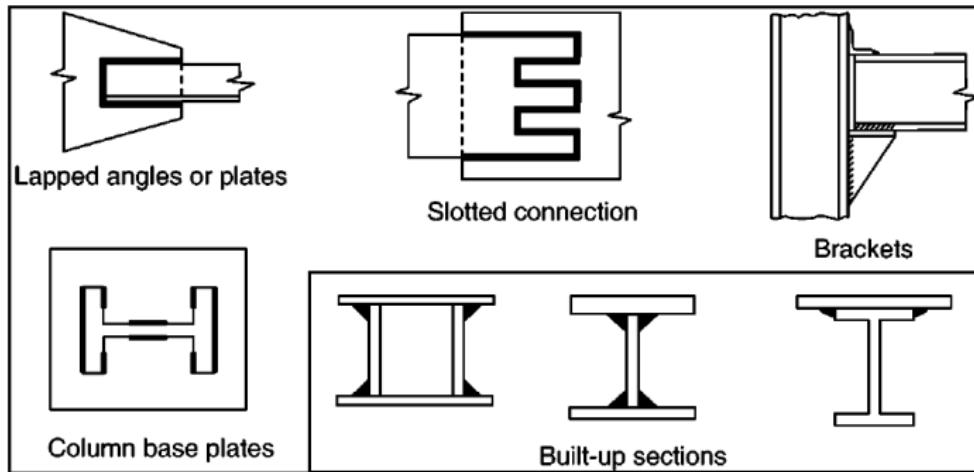
- In connections, members generally intersect at right angles, but intersection angles between 60° and 120° can be used.
- They fail in shear.
- Most widely used due to their economy, ease of fabrication, and adoptability at site. Hence, fillet welds are used extensively (about 80%) followed by groove welds (15%).



Types of Weld

Fillet Weld

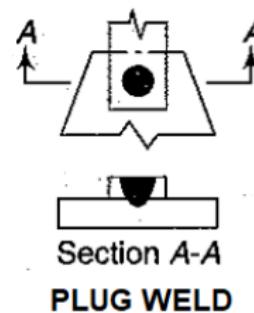
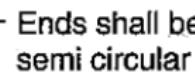
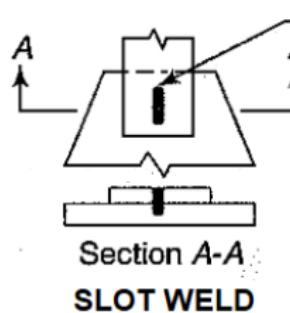
- They have the following application.



Types of Weld

Slot Weld & Plug Weld

- Slot and plug welds are not used exclusively in steel construction.
- When it becomes impossible to use fillet welds or when the length of the fillet weld is limited, slot and plug welds are used to supplement the fillet welds.
- They are also assumed to fail in shear. Thus, their design strength is similar to that of fillet welds.



Design of Welds

Assumptions

The following assumptions are usually made in the design of welded joints.

- ① The welds connecting the various parts are homogenous, isotropic, and elastic.
- ② The parts connected by the welds are rigid and their deformation is, therefore, neglected.
- ③ Only stresses due to external forces are considered. The effects of residual stresses, stress concentrations, and the shape of the weld are neglected.



THANK YOU...

